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**MVP**

14.5-15.25 Oz. - Select Varieties

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**Canned Vegetables**

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**microwave or**

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OCT 28 2015





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**OCT 29 2015**



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**Hillshire Fa  
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OCT 29 2015



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for details.

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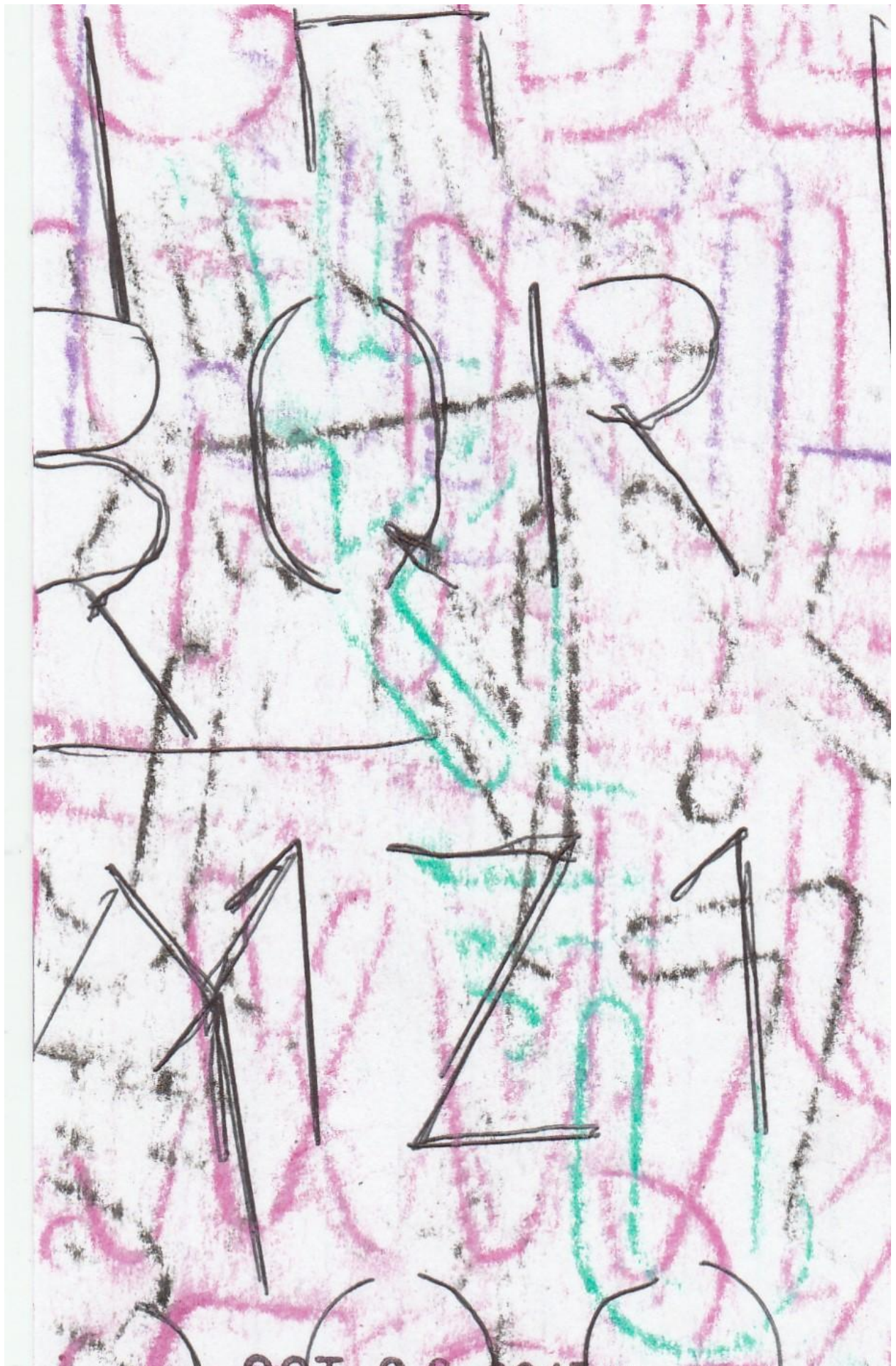
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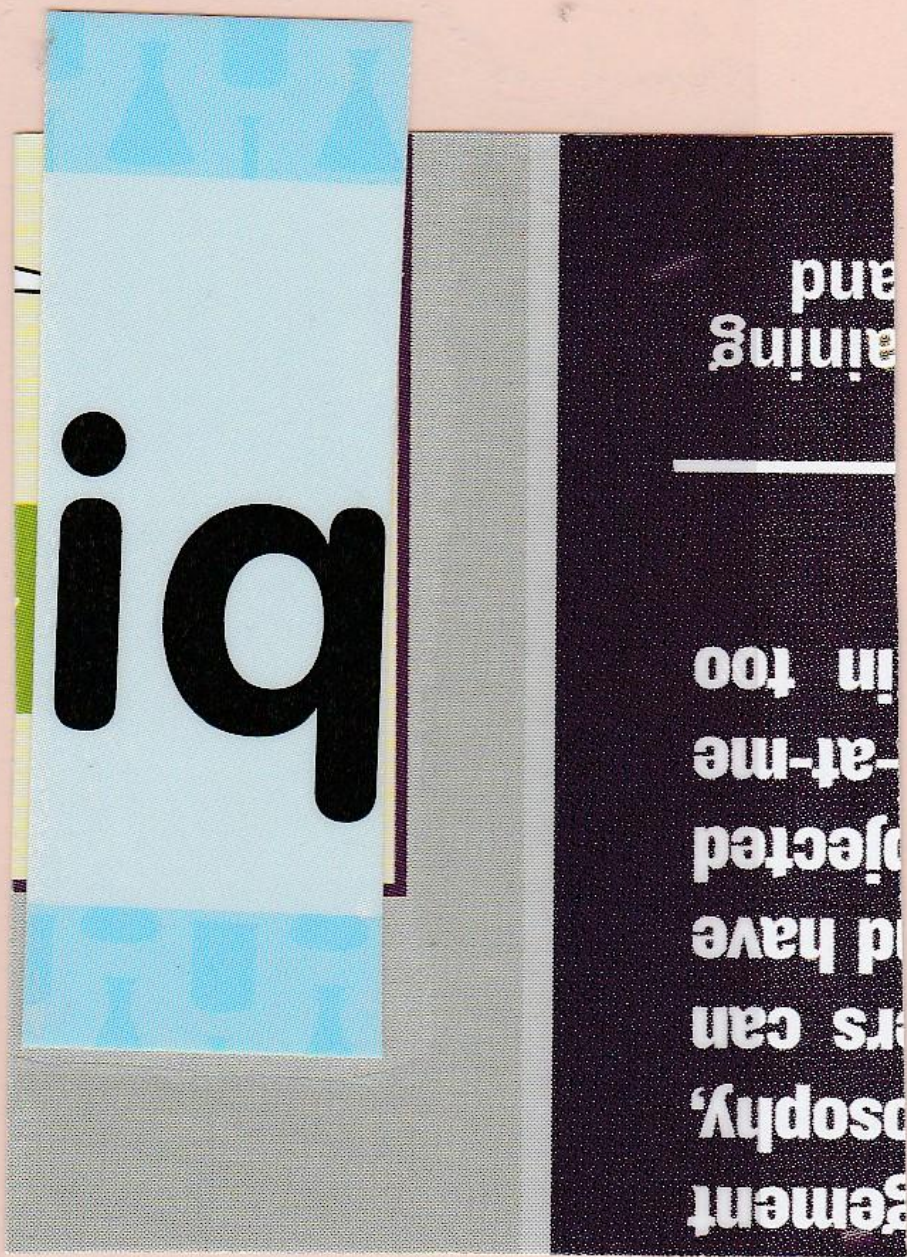






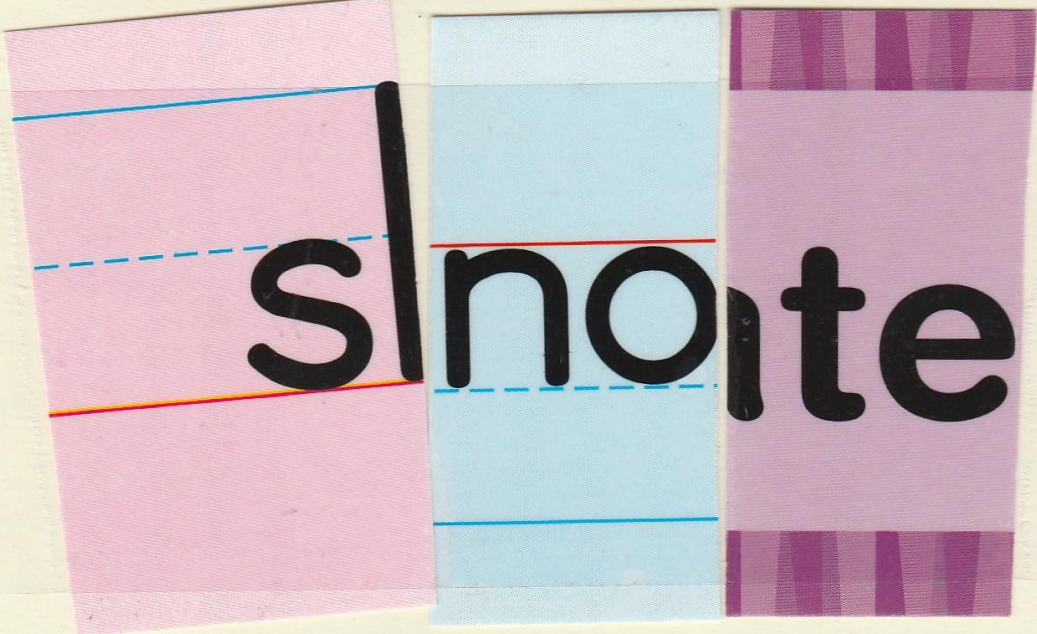






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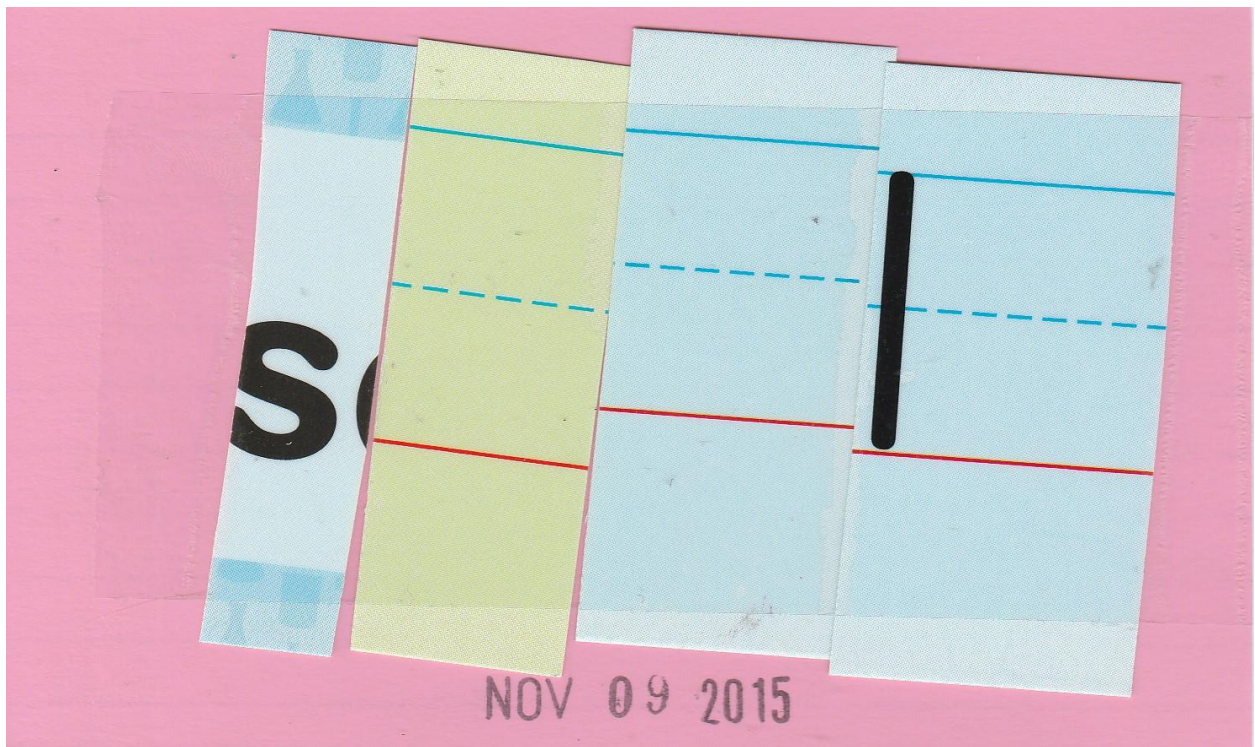
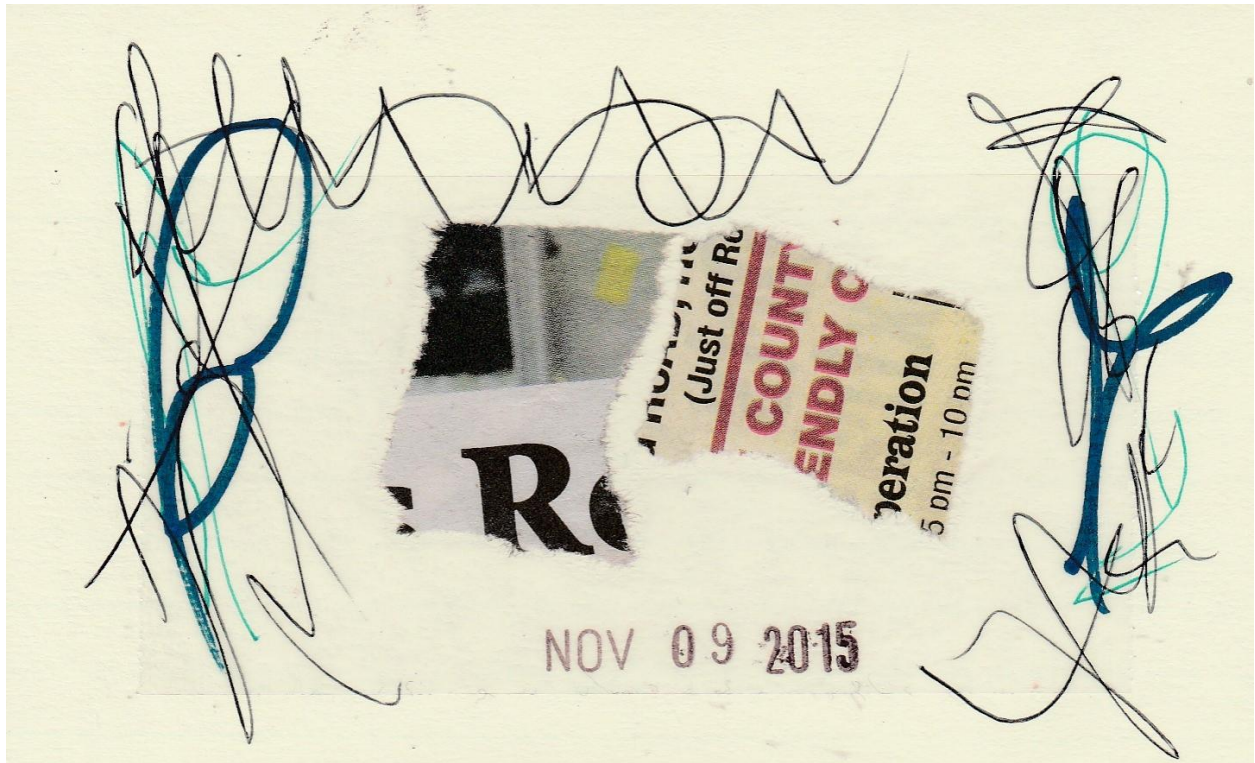
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95 They knew not of his story,  
 And sage Hippotades<sup>5</sup> their answers brings,  
 That not a blast was from his dunce<sup>6</sup> con-strayed,  
 The air was calm, and on the level brine,  
 Sleek Panope<sup>6</sup> with all her sisters played.  
 100 It was that fatal and perfidious bark  
 Built in th' eclipse, and rigged with curses dark,  
 That sunk so low that sacred fount<sup>7</sup> of state.  
 Next Camus,<sup>7</sup> reverend sire, went footing slow,  
 His mantle hairy, and his bonnet sear,  
 105 Inwrought with figures ill, and on the edge  
 Like to that sanguine flower inscribed with woe.<sup>8</sup>  
 "Alas, who hath reit," quoth he, "my dear pledge?"  
 Last came and last did go  
 The pilot of the Galilean lake,<sup>9</sup>  
 110 Two massy keys he bore of metals twain  
 (The golden opes, the iron shuts amain).  
 He shook his mitered locks, and stern bespake:  
 "How well could I have spared for thee, young swain,  
 Enow<sup>9</sup> of such as for their bellies' sake,  
 115 Creep and intrude, and climb into the fold!  
 Of other care they little reckoning make,  
 Than how to scramble at the shearers' feast,  
 And shove away the worthy bidden guest.  
 Blind mouths! That scarce themselves know how to hold  
 120 A sheep-hook, or have knowledge aught else the least  
 That to the faithful<sup>10</sup> man's art belongs!  
 What recks it them? What need they? They are sped;  
 And when they list, their lean and flashy<sup>11</sup> songs  
 Crate on their scamnel<sup>12</sup> pipes of wretched straw,  
 125 The hungry sheep look up, and are not fed,  
 But swoll with wind, and the rank mist they draw,  
 Rot inwardly, and foul contagion spread,  
 Besides what the grim wolf with privy paw<sup>2</sup>  
 Daily devours apace, and nothing said,  
 130 But that two-handed engine at the door  
 Stands ready to smite once, and smite no more."<sup>3</sup>  
 Return, Alpheus,<sup>4</sup> the dread voice is past,  
 That shrunk thy streams; return, Sicilian muse,  
 And call the vales, and bid them hither cast  
 135 Their bells and flowerets of a thousand hues.  
 Ye valleys low where the mild whispers use  
 Of shades and wanton winds, and gushing brooks,  
 On whose fresh lap the swart star<sup>5</sup> sparely looks,  
 Throw hither all your quaint enameled eyes,  
 140 That on the green turf suck the honeyed showers,  
 And purple all the ground with vernal flowers.  
 Bring the rathe<sup>6</sup> primrose that forsaken dies,  
 The tufted crow-toe, and pale jessamine

enough

insipid  
meager

frequent

early

5. Aeolus, son of Hippotas and god of the winds.

6. One of the Nereids, daughters of Nereus, the Old Man of the Sea.

7. The god of the river Cam, representing Cambridge University.

8. The hyacinth, created by Apollo from the blood of the youth Hyacinthus, whom he had killed by accident with a discus. Certain markings on the flower are supposed to be the letters AIAI ("Alas, alas!"), inscribed there by Apollo.

9. St. Peter, the Galilean fisherman, to whom Christ promised the keys of the kingdom of heaven (Matthew xvii:19). He wears the

2. I.e., anti-Protestant forces, either Roman Catholic or Anglican.

3. A satisfactory explanation of these two lines has yet to be made, although many have been attempted. Most have taken the "two-handed engine" as an instrument of retribution against those clergy who neglect their responsibilities (such as the act of reformation; the two-handed sword of the archangel Michael; the two houses of Parliament; death and damnation).

4. A river god who fell in love with the nymph Arethusa. When she fled to Sicily he pursued her by diving under the sea and coming up in the island. There she was turned into a foun-



Will take from both a deep, autumnal tone,  
Sweet though in sadness. Be thou, Spirit fierce,  
My spirit! Be thou more impetuous yet!

Drive my dead thoughts over the universe  
Like withered leaves blown to a new birth!  
65 And, by the incantation of this verse,

Scatter, as from an unextinguished hearth,  
Ashes and sparks of my words among mankind!  
Be through all quarters to a new dawned earth

The trumpet shall be peal'd! O Wind,  
70 If Winter comes, can Spring be far behind?

1820

## The Cloud

I bring fresh showers for the thirsting flowers,  
From the seas and the streams;  
I bear light vanes for the leaves when laid  
In their beds of green dreams.

5 From my wings are shaken the dews that waken  
The sweet buds as they grow,  
When rocked to rest on their mother's breast,  
As she dances about the sun.

I wield the flail of the lashing hail,  
10 And whiten the green plains under,  
And then again I dissolve it in rain,  
And laugh as I pass in thunder.

I sift the snow on the mountains below,  
And their great pines groan aghast;  
15 And all the night 'tis my pillow to lie,  
While I sleep in the arms of the blast.  
Sublime on the towers of my slaty bowers,  
Lightning my battle dress,

In a cavern under is reared the thunder,  
20 It struggles and howls at fits;  
Over earth and ocean, with gentle motion,  
This pilot is guiding me.

Lured by the love of the genii that move  
In the depths of the purple sea;

25 Over the rills, and the crags, and the hills,  
Over the lakes and the plains,  
Wherever he dream, under mountain or stream,  
The Spirit he loves remains;  
And I all the while bask in Heaven's blue smile,  
30 Whilst he is dissolving in rains.

The sanguine Sunrise, with his meteor eyes,  
And his burning plumes outspread,  
Leaps on the back of my sailing rack;<sup>1</sup>

When the morning star shines dead;  
35 As on the jag of a mountain crag,  
Which an earthquake rocks and swings,  
An eagle alit one moment may sit  
In the light of its golden wings.

intermittently



2  
Spirit of BEAUTY, that dost consecrate

With thine own hues all thou dost shine upon

15 Of human form—where art thou gone?

Why dost thou peep from our state,

This cold world of ours so dreary and desolate?

Thy light is not forever

Thy smile flows o'er yon mountain river,

20 But still it fail and fade that once is shown,

Thy fear and dream and death and birth

Are lost in the daylight of this earth

Such gloom—why man has such a scope

For life and love—spondency and hope?

3

25 No voice from some sublimer world hath ever

To sage or poet these responses given—

Therefore the flames of Daemon, Ghost, and Heaven,

Remain the records of their vain endeavor,

Frail pens—whose uttered charm might not avail to sever,

30 From all we hear and all we see,

Doubt, change, and mutability.

Thy light alone—thou art o'er mountains drawn,

Or music by the soft wind sent

Through strings of some sweet instrument,

35 Or moon light on a midnight sea—

Give grace and glory to life's and love's

4

Love, Hope, and Self-esteem, thy powers depart

And come, for some uncertain moments lent.

Man were immortal and omnipotent

40 Didst thou, unknown and awful as thou art

Keep with thy glorious train? firm state within his heart.

Thou messenger of sympathies,

That wax and wane in lovers' eyes—

Thou—that to human thought art nourishment,

45 Like darkness to a dying flame!

Depart not as thy shadow came,

Depart not—lest the grave should be

Like life and fear, a dark reality

5

When yet a boy I sought for ghosts, and sped

50 Through many a lonely chamber, cave and ruin

And starlight with fearful steps pursued

Hopes of high talk with the departed dead

I called on poisonous names—with which our world is fed;

I was not heedless—I saw them not—

55 When next I slept on the lone

Of life, I had seen the vision of things

All the things that wake to bring

News of birds and blossoming—

Sudden, thy shadow fell on me;

60 I shrieked, and clasped my hands in ecstasy!

6

I vowed that I would dedicate my powers

To thee and thine—have I not kept the vow?

With beating heart and streaming eyes, even now

I call the phantoms of a thousand hours

65 Each from his voiceless grave: they have in visioned bowers

Of studious zeal or love's delight

Outwatched with me the envious night—



2  
5 If, when the wintry tempest roared,  
He sped to Hero, nothing loath,  
And thus of old thy current poured,  
Fair Venus! how I pity her!

3  
10 For me, degenerate mortal wretch,  
Though in the genial month of May,  
My dripping limbs I find stretch,  
And think I've done what I may.

But since the course is run, and the  
According to the story,  
15 To wood and-Lord! what beside,  
And I am for the glory;

5  
'Twas hard to say, and the best  
Say mortals! thus gods still plague  
Hearts labor, and rest,  
He was drowned, and I with him.

chills and fever  
1812

## The Destruction of Sennacherib<sup>2</sup>

1  
The Assyrian came down like the wolf on the fold,  
And his cohorts were gleaming in purple and gold;  
And the sheen of their spears was like stars on the sea,  
When the blue wave fell night on deep Galilee.

2  
5 Like the leaves of the forest when summer is green,  
That host with their banners at sunset were seen:  
Like the leaves of the forest when autumn hath blown,  
That host on the morrow lay withered and strewn.

3  
10 For the Angel of Death spread his wings on the blast,  
And breathed in the face of the foe as he passed;  
And the eyes of the sleepers fell heavily and chill,  
And their hearts but once heaved, and forever grew still!

4  
15 And there lay the steed with his nostril all wide,  
But through it there rolled not the breath of his pride;  
And the foam of his gaping lay white on the turf,  
And cold as the spray of the rock-beating surf.

5  
20 And there lay the rider distorted and pale,  
With the dew on his brow and the rust on his mail:  
And the tents were all silent, the banners alone,  
The lances unlifted, the trumpet unblown.

6  
And the widows of the city are loud in their wail,  
And the idols are broke in the temple of Baal;<sup>4</sup>  
And the might of the Gentile,<sup>5</sup> broke by the sword,  
Hath melted like snow in the glance of the Lord!



O for some airy Morphean amulet!<sup>3</sup>  
 The boisterous midnight, festive clarion,  
 The kettle-drum, the far-heard clarinet,  
 260 Affray, hubbub, though but in dying tone—  
 The hall was hushed again, and all the noise is gone.

And he who slept an azure-lidded sleep,  
 In light blue linen, smooth, and lavendered,  
 265 Vainly from forth the closet brought a heap  
 Of red apple, orange, and quince, and gourd;  
 No mellies soother than the creamy curd,  
 And luscious syrups, tinct<sup>o</sup> with cinnamon;  
 Manna and dates, in argosies transferred  
 From Fez;<sup>4</sup> and spiced delicacies every one,  
 270 From silken Samarcand, and cedar Lebanon.<sup>5</sup>

31  
 These delicacies he heaped with glowing hand  
 On golden dishes and in baskets bright  
 Of wreathed silver: sumptuous they stand  
 In the retired quiet of the night,  
 275 Filling the chilly room with perfume light.—  
 “And now, my love, my seraph<sup>o</sup> fair, awakel  
 Thou art my heaven, and I thine eremite.<sup>6</sup>  
 Open thine eyes, for meek St. Agnes’ sake,  
 Or I shall drowse beside thee, so my soul doth ache.”

32  
 280 Thus whispering, his warm, unnerved arm  
 Sank in her pillow. Shaded was her dream  
 By the dusk curtains: ’twas a midnight charm  
 Impossible to melt as icéd stream:  
 The lustrous salvers<sup>o</sup> in the moonlight gleam;  
 285 Broad golden fringe upon the carpet lies:  
 It seemed he never, never could redeem  
 From such a steadfast spell his lady’s eyes:  
 So mused awhile, entoi<sup>l</sup>ed in woofed<sup>o</sup> fantasies.

33  
 290 Awake, and up, he took her hollow lute—  
 Tumultuous—and, in chords that tenderest be,  
 He played an ancient ditty, long since mute,  
 In Provence called “*La belle dame sans merci*”<sup>7</sup>  
 Close to her ear touching the melody,  
 Wherewith disturbed, she uttered a soft moan.  
 295 He ceased—she panted quick—and suddenly  
 Her blue an<sup>l</sup>ayed eyes wide open shone.  
 Upon his knees he sank, pale as smooth-sculptured stone.

34  
 Her eyes were open, but she still beheld  
 Now wide awake the vision of her sleep:  
 300 There was a painful change, that nigh expelled  
 The bliss of her dream so pure and deep,  
 At which fair Fidelity began to weep  
 And moan forth witless words with many a sigh:  
 While still her gaze on Porphyro would keep.  
 305 Who knelt with joined hands and piteous eve,  
 Fearing to move, or speak, she looked so dreamingly.

35  
 “Ah, Porphyro!” said she, “but even now  
 Thy voice was at sweet tremble in mine ear,  
 Made tunable with every sweetest vow;

tinctured

angel

serving dishes

enwoven



155 "Alas, why wilt thou fright a feeble soul?  
 A poor, weak, broken, churchyard thing,<sup>4</sup>  
 Whose passing may ere the midnight toll;  
 Whose prayers for thee, each morn and evening,  
 Were never missed."—Thus plaining,<sup>5</sup> doth she bring *complaining*  
 A gentler speech from burning Porphyro;  
 160 So woeful and of such deep sorrowing,  
 That Angela gives promise she will do  
 Whatever he shall wish, betide her weal or woe.

19  
 Which was, to lead him, in close secrecy,  
 Even to Madeline's chamber, and there hide  
 165 Him in a closet, of such privacy  
 That he might see her beauty unespied,  
 And win perhaps that night a peerless bride.  
 While legioned faeries paced the coverlet,  
 And pale enchantment held her sleepy-eyed.  
 170 Never on such a night have lovers met,  
 Since Merlin paid his Demon all the monstrous debt.<sup>6</sup>

20  
 "It shall be as thou wishest," said the Dame:  
 "All cates<sup>7</sup> and dainties shall be stored there  
 Quickly on this feast<sup>8</sup> night: by the tambour frame<sup>8</sup>  
 175 Her own lute thou wilt see: no time to spare,  
 For I am slow and feeble, and scarce dare  
 On such a catering trust my dizzy head.  
 Wait here, my child, with patience; kneel in prayer  
 The while: And thou must needs the lady wed.  
 180 Or may I never leave my grave among the dead."

21  
 So saying, she hobbled off with busy fear.  
 The lover's endless minutes slowly passed:  
 The dame returned, and whispered in his ear  
 To follow her; with aged eyes aghast  
 185 From fright of dim espial. Safe at last  
 Through many a dusky gallery, they gain  
 The maiden's chamber, silken, hushed, and chaste;  
 Where Porphyro took covert, pleased amain.<sup>9</sup>  
 His poor guide hurried back with agues in her brain.

22  
 190 Her falt'ring hand upon the balustrade,  
 Old Angela was feeling for the stair,  
 When Madeline, St. Angelo's charmed maid,  
 Rose, like a missioned saint, unaware;  
 With silver taper's light, and pious care,  
 195 She turned, and down the aged gossip led  
 To a safe level matting. Now prepare,  
 Young Porphyro, for gazing on that bed;  
 She comes, she comes again, like ringdove frayed<sup>10</sup> and fled. *affrighted*

23  
 200 Out went the taper as she hurried in;  
 Its little smoke, in pallid moonshine, died:  
 She closed the door, she panted, all akin  
 To spirits of the air, and visions wide:  
 No uttered syllable, or, woe betide!



45 These shall come to you or yours:  
 But that pack of churlish boors,  
 Not fit to live on Christian ground,  
 They and their houses shall be drest:  
 Whilst you shall see your cottages rise,  
 50 And grow a church before your eyes.  
 They scarce had spoke, when light and soft,  
 The roof began to mount aloft:  
 Aloft rose every beam and rafter,  
 The heavy wall climbed slowly after.  
 55 The chimney widened, and grew higher,  
 Became a steeple with a spire.

The kettle to the top was hoist,  
 And there stood fastened to a joist;  
 But with the upside down, to show  
 60 Its inclinations for below:  
 In vain; for a superior force  
 Applied at bottom, stops its course,  
 Doomed ever in suspense to dwell,  
 Tis now no kettle, but a bell.

A wooden jack, which had almost  
 Lost, by disuse, the art to roast,  
 A sudden alteration feels,  
 Increased by new machine<sup>8</sup> wheels,  
 And, what exalts the wonder more,  
 The number made the motion slower,  
 The flyer, though't had leaden feet,<sup>8</sup>  
 Turned round so quick, you scarce could see it,  
 But slackened by some secret power,  
 Now hardly moves an inch an hour.  
 75 The jack and chimney, near allied,  
 Had never left each other's side:  
 The chimney to a steeple grown,  
 The jack would not be left alone,  
 But up against the steeple reared,  
 80 Became a clock, and still adhered:  
 And still its love to household cares  
 By a shrill voice at noon declares,  
 Warning the cook-maid not to burn  
 That roast meat which it cannot turn.

85 The groaning chair began to crawl  
 Like an huge snail along the wall,  
 There stuck aloft, in public view,  
 And with small change a pulpit grew.  
 The porringers, that in a row  
 90 Hung high and made a glittering show,  
 To a less noble substance changed,  
 Were now but leathern buckets ranged.<sup>9</sup>

The ballads pasted on the wall,  
 Of Joan of France and English Moll,  
 95 Fair Rosamond and Robin Hood,  
 The Little Children in the Wood,  
 Now seemed to look abundance better,  
 Improved in picture, size, and letter,  
 And in an order placed, describe  
 100 The heroes of every tribe.

A bedstead of the antique mode,  
 Compact<sup>9</sup> and many a load,

internal

composed



## A Description of a City Shower 179

Nay, now I cannot stir my foot:  
It feels as if 'twere taking root."  
Description would be to my Muse:  
In short, they both were turned to yews.

165 Old Goodman Dobson of the green  
Remembers he the trees has seen;  
He'll talk of them from noon to night,  
And goes with folks to show the  
On Sundays, after evening pray  
170 He gathers all the parish there;  
Points out the place of either yew:  
Here Baucis, there Philemon grew:  
Till, see, a storm our town,  
To mend his barn, but Baucis down;  
175 At which, 'tis hard to be believed  
How much the other tree was grieved,  
Grew scrubby, died a-top, was stunted;  
So the next parson stubbed and burnt it.

## A Description of a City Shower

Careful observers may foretell the hour  
(By sure prognostics) when to dread a shower:  
While rain descends, the porcupine gives o'er  
Her frolics, and pursues her tail no more.  
5 Returning home at night, you'll find the snail  
Strike you offence, and sense with double stink.  
If you be wise, then go to bed to dine;  
You'll spend in coach hire more than save in wine.  
A coming shower your shooting corn presage,  
10 Old aches throb, your law tooth a rage.  
Suntering in coffeehouse is Dublin's queen;  
He dares the climate and commands of spleen.  
Meanwhile the South, winged with dabbled wings,  
A sable cloud athwart the welkin  
15 That smiled more liquor than could contain,  
And, like a drunkard, gives it up again.  
Brisk Susan whips her wench from the rope,  
While the first drizzling shower is borne aslope:  
Such is that sprinkling which some careless queen  
20 Flirts on you from her mop, but not so clean:  
You fly, invoke the gods; then turning, stop  
To rail: she singing, still whirls on her mop.  
Not yet the dust had shunned the unequal strife,  
But, aided by the wind, fought still for life,  
25 And wafted with its foe by violent gust,  
'Twas doubtful which was rain and which was dust.  
Ah! where must poor poet seek for aid?  
When down he falls, at once his coat invades  
Sole coat, and cemented by the rain  
30 Erects the man, and gives a mingled stain.

Now in contiguous drops the flood comes down,  
Threatening with deluge this devoted town.  
To shops in crowds the daggled females fly  
Pretend to cheapen goods, but nothing buy.  
35 The Templar's spirit, while every spot's abroad,  
Stays till 'tis fair, yet seems to call a coach.  
The tucked-up sempstress walks with hasty strides,  
While streams run down her oiled umbrella sides.  
Here various kinds, by various fashions,  
40 Commence acquaintance under various shades.

depends  
seer

dull-man  
melancholy  
outh wind  
sky

wench

doomed  
spattered  
pri

law student / runner



JOHN MILTON  
(1608-1674)

# Lycidas

IN THIS MONODY<sup>1</sup> THE AUTHOR BEWAILS A LEARNED FRIEND, UNFORTUNATELY DROWNED IN HIS PASSAGE FROM CHESTER ON THE IRISH SEAS, 1637. AND BY OCCASION FORETELLS THE RUIN OF OUR CORRUPTED CLERGY, THEN IN THEIR HEIGHT.

Yet once more, O ye laurels<sup>2</sup> and once more  
Ye myrtles brown<sup>3</sup> with ivy never sere,<sup>4</sup>  
I come to pluck your berries harsh and crude,<sup>5</sup>  
And with those rough and rugged fingers rude,  
Shatter your leaves before the mellowing year.  
Bitter constraint, and sad occasion dear,  
Compels me to disturb your season due;  
For Lycidas is dead, dead ere his prime,  
Young Lycidas, and hath not left his peer.  
Who would not sing for Lycidas? He knew  
Himself to sing, and build the lofty rhyme.  
He must not float upon his watery bier  
Unwept, and welter<sup>6</sup> to the parching wind,  
Without the meed<sup>7</sup> of some melodious tear.

Begin then, sisters of the sacred well<sup>8</sup>  
That from beneath the seat of Jove doth spring,  
Begin, and somewhat loudly sweep the string.  
Hence with dead weight, and cloy excuse;  
So may some gentle Muse<sup>9</sup>  
With lucky words favor my destined urn,  
And as he passes turn  
And bid fair peace be to my sable shroud.  
For we were nursed upon the selfsame hill,  
Fed the same flock, by fountain, shade, and rill.

Together both, ere the high lawns<sup>10</sup> appeared  
Under the opening eyelids of the morn,  
We drove afield, and both together heard  
What time the grayfly winds her sultry horn.  
Battering<sup>11</sup> our flocks with the fresh dew of night,  
Oft till the star that rose at evening bright  
Toward Heaven's descent had sloped his westerling wheel,  
Meanwhile the rural ditties were not mute,  
Tempered to the oaten flute.  
Rough satyrs danced, and fauns with cloven heel  
From the glad sound would not be absent long.  
And old Damoetas<sup>12</sup> loved to hear our song.

But O the heavy change, now thou art gone,  
Now thou art gone, and never must return!  
Thee, shepherd, thee the woods and desert caves,  
With wild thyme and the gadding<sup>13</sup> vine o'ergrown,  
And all their echoes mourn.  
The willows and the hazel copses green  
Shall now no more be seen,  
Fanning their joyous leaves to thy soft lays.

dark / withered  
unripe

severe

roll about  
tribute

poet

pastures

fattening

wandering

1. An elegy or dirge sung by a single voice. The "learned friend" is Edward King, Milton's fellow student at Cambridge.  
2. The laurel, myrtle, and ivy were additional materials for poetic garlands.

3. The Muses. The well sacred to them was Castille, at the foot of Mt. Helicon, where they danced about the altar of Jove.

4. A conventional pastoral name, here perhaps referring to one of the tutors at Cambridge.



340 Alfred, Lord Tennyson

Calm and still light on yon great plain  
10 That sweeps with all its autumn bowers,  
And crowded farms and lessening towers,  
To mingle with the bounding main;

Calm and deep peace in this wide air,  
15 And leaves that redden to the fall;  
And in my heart, if calm at all,  
If any calm, a calm despair;

Calm on the seas, and silver shrouds  
And waves that sway them;  
And dead calm in the noble  
20 which heaves but with the lull;

19  
The Danube to the Sava,  
The darkened heaves of the  
They laid him low,  
And in the heart of the sea.

Where twice a year the corn fills  
The salt seas by the  
And hushes the bubbling Wye,<sup>8</sup>  
And makes a noise in the trees.

The Wye is hushed nor flows along,  
10 And hushed my deep grief of all,  
When filled with tears that cannot fall,  
I brim with sorrow-drawing song.

The tide flows down, the wave again  
Is vocal in its wooded walls;  
15 My deeper anguish also falls,  
And I can speak a little then.

I envy not in any moods  
The captive void of noble rage,  
The linnet born within the cage  
That never knew the summer winds;

5 I envy not the beast that takes  
His sense in the field of sense,  
Untroubled by the sense of conscience,  
To whom a conscience never comes;

Nor, what may come, as blest,  
10 The heart that never plighted troth  
But stagnates in the weeds of sloth;  
Nor any want of gotten rest.<sup>9</sup>

Had it been whate'er befall;  
I feel when I sorrow most;  
15 'Tis better to have loved and lost  
Than never to have loved at all.

50  
Be near me when my light is low,  
When the blood creeps, and the heart sick  
And tingle; and the heart is sick  
And all the soul is sick;

<sup>8</sup> The Wye, a tributary of the Bristol Avon, flows into the sea at the mouth of the river and makes it quiet, but the tide ebbs the Wye once more becomes a noisy stream. Some think the Wye comes merely from ignorance of the river's course.



in two different states. In a fixed solution of ferrous iron and ferric iron, iron behaves as the "fuel" that is oxidized to ferric iron on the surface of the electrode. At the other electrode, another reduction-oxidation couple (redox couple), such as a mixture of bromine and bromide ions, acts as an oxidant. When a current is drawn, the two electrolytes become richer in the products of reaction. To avoid a direct chemical reaction between the reactants, a porous separator keeps the two electrolytes apart, permitting the transfer of common ions but not the reactive ions themselves.

The electrolyte in the fuel compartment is circulated through a regenerator, in which it is reduced from the ferric to the ferrous form by means of a secondary fuel, such as hydrogen or carbon monoxide. The secondary fuel is regenerated by blowing air through the regenerator. Both of these processes are an example of a catalytic cycle, but no electrochemical reaction is involved.

This type of cell has been limited in its practical interest because of the complexity of the system, the inefficiency of the regenerative processes, and the porous separator, and the need for a secondary fuel. Much progress has been made toward the "dry-cell" electrodes, of the types described previously.

**Other fuel cells.** Another type of fuel cell is the solid oxide such as zirconia, which is stable at temperatures approximately 1,650° F. (900° C.). The electrolyte is zirconia, stabilized in the solid state by the addition of calcium oxide. The electrodes are made on either side with porous metal, such as nickel or nickel oxide. At the high temperature, hydrocarbon fuels are broken down into hydrogen and carbon monoxide. Hydrogen, which reacts with the oxide ion, is oxidized. Oxide ions are replaced by the reduction of atmospheric oxygen at the other electrode. Problems of materials stability, particularly at the high temperatures, have prevented this type of cell from being practical. It would have to be limited to stationary power and maintained at about 1,830° F. (1,000° C.).

A special type of alkaline cell has been developed, using a substance as fuel rather than a gas. The substance is dissolved in a potassium-hydroxide electrolyte. The fuel is a solid substance.

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of either hydrogen or oxygen. Water evapo-  
removed from the cell either by a system of  
on the edge of the nickel plates or by a coolant  
through the hollow passages within the plates.  
In free-electrolyte cells, the electrodes are a  
structure with a fine-pore layer on the side  
the surface. Gas is fed to the surface of the el-  
to overcome surface-tensi-  
from the fine pores. Such  
the surface is made more cases by making  
the electrode structure proof with polytetraflu-  
one or paraffin wax. Electrodes of nickel and of  
have been used.

To obtain a reaction between hydrogen and oxy-  
temperatures around 32° to 160° F (0° to 70° C)  
normal regime for these cells, highly active catalysts  
used. Most frequently, platinum group metals in the  
dized form, known as blacks, have been employed.  
and carbon also have been used as oxygen electro-  
while nickel and nickel boride have been used at the  
hydrogen electrode.

Although it requires pure gas supplies, this type of cell  
starts operation at room temperatures or below and has  
found use in specialized military and space application  
enough demonstrated in a number of commercial ap-  
plications. It has not yet been produced in commercial  
quantities.

Fused-salt electrolyte type. For the use of expen-  
sive catalysts, work has been carried out on fuel  
cells operating at higher temperatures. Experimental work  
has been carried out at 300° to 400° C, using aqueous  
electrolytes pressurized to 600 pounds per square inch  
in which the various metal catalysts were not used. A  
modification of this type of cell using 85 per-  
cent potassium hydroxide as electrolyte has been  
operated at 400° to 500° C. This system was developed  
between 1957 and 1967 and provided electrical power  
for several space-flights including the first manned moon  
landings.

Space  
flight  
power



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An experimental cell that has been developed uses a mixture of sodium-potassium-lithium carbonates and operates at approximately 500° to 600° F. (500° to 700° C). The electrolyte is a mixture of these salts in the pores of a ceramic matrix analogous to the cathode of the cell just described. The electrodes are porous metal layers applied to each face of the matrix. A layer of nickel at the fuel side and a layer of nickel oxide at the oxidant side.

A mixture of carbon monoxide and hydrogen is fed to the electrode, where it reacts to form carbon ions. These ions are transmitted through the electrolyte to the fuel electrode, where they are discharged in reaction with the carbon monoxide to form carbon dioxide (and water). The addition of carbon dioxide to the fuel gas stream in contrast to the other cells is necessary to prevent the oxide to be

removed by mixing the fuel gas with the oxidant gas. The fuel must first

be converted to a mixture of carbon monoxide and hydrogen. This mixture of carbon monoxide and hydrogen is then fed to the fuel electrode. The cell has been operated on such hydrocarbon fuels as kerosene.

Though this type of cell is cheap to construct and simple to operate, its corrosion and instability have limited its use, and no commercial applications have been found. It is particularly suitable as a combined heat and power unit, and hot water for small-scale domestic and industrial units.

**Redox type.** Bringing together the three phases—gas, liquid, and solid—at the electrode is one of the major problems with the fuel cell. The redox (reduction-oxidation) cell eliminates the problem. In it, a solid catalytic metal electrode is placed in contact with an electrolyte containing a dissolved substance in two states of oxidation; for



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**Aqueous-alkaline fuel-cell type.** Alkaline electrolytes in general are less corrosive than acids, permitting the use of a wider range of materials. For this reason, much research and development have been directed outwards from the work on acid fuel-cell systems. Unfortunately, carbon dioxide, which is backed up by carbon monoxide, formed in the combustion of carbonaceous fuels, is a minor constituent of atmospheric air, the product of oxidation of hydrocarbons, and a common impurity in commercial hydrogen supplies, and must be completely removed from the feed to alkaline fuel cells.

Capillary cell

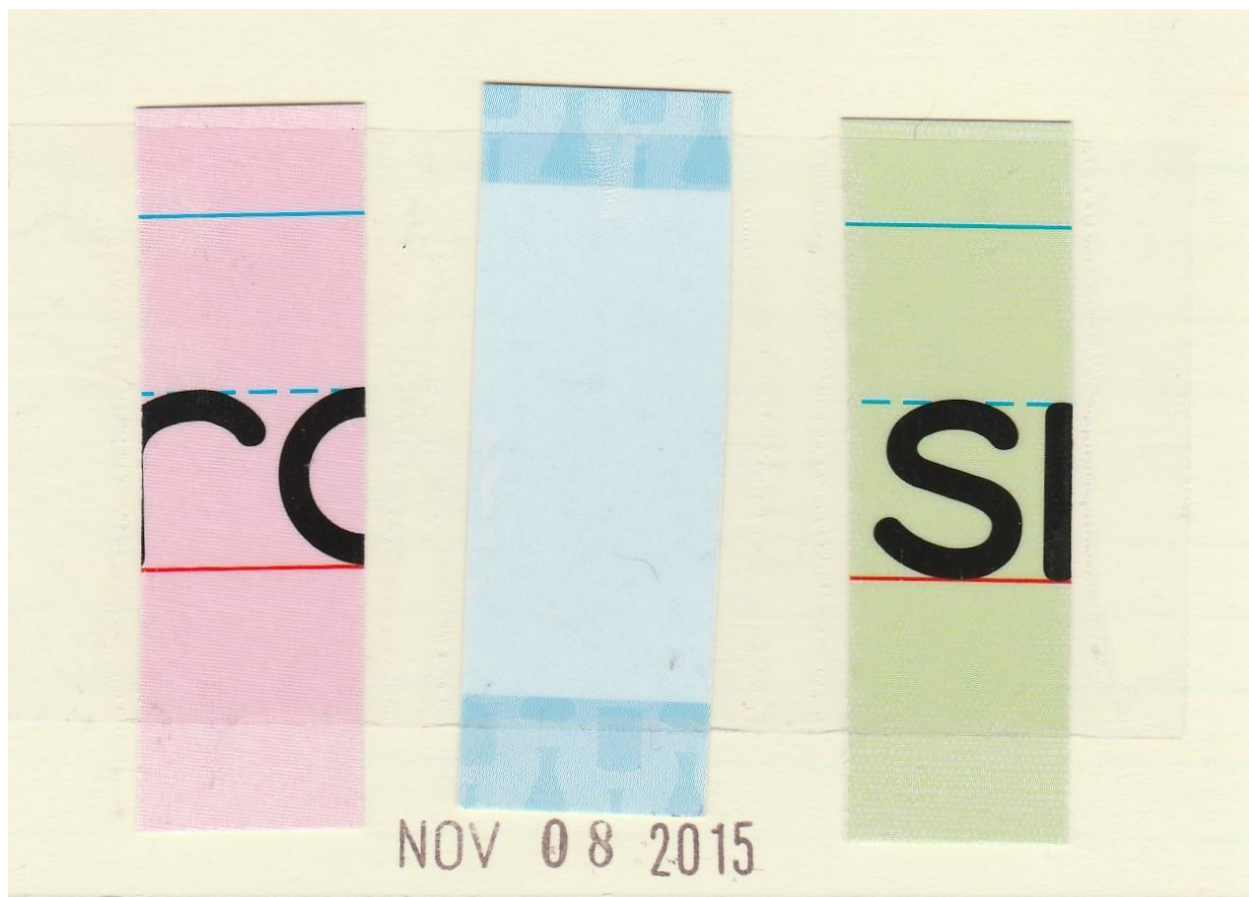
Two different types of aqueous-alkaline electrolyte fuel cells have been developed. One is known as the capillary cell, or trapped electrolyte cell, in which the electrolyte is contained within the pores of an insulating matrix—typically a mat of asbestos paper or glass-fibre filter paper. The other is the free electrolyte cell, in which the electrolyte is circulated through the gap between two electrodes.

In the capillary cell, the electrodes are formed by a mixture of a powdered catalyst such as platinum, and a wetproofing agent, such as the organic compound polytetrafluoroethylene. This mixture is embedded in the pores of a woven metal screen, usually nickel, which acts as an electrical conductor and structural member. The electrodes are clamped against opposite faces of the screen matrix material by two insulating plates of nickel or nickel-plated steel. Grooves are formed so as to form grooves or passages for the electrolyte supply to flow between the plate and the screen, and the parts in contact with the electrolyte. The electrons from the electrode pass through the adjacent screen and into the electrolyte. The electrolyte, within the pores of the matrix, wetproofed by the polytetrafluoroethylene, which in the form of fine dispersed particles in a porous mass. Water produced in the reaction of hydrogen and oxygen, for example, is carried from the cell by an ex-









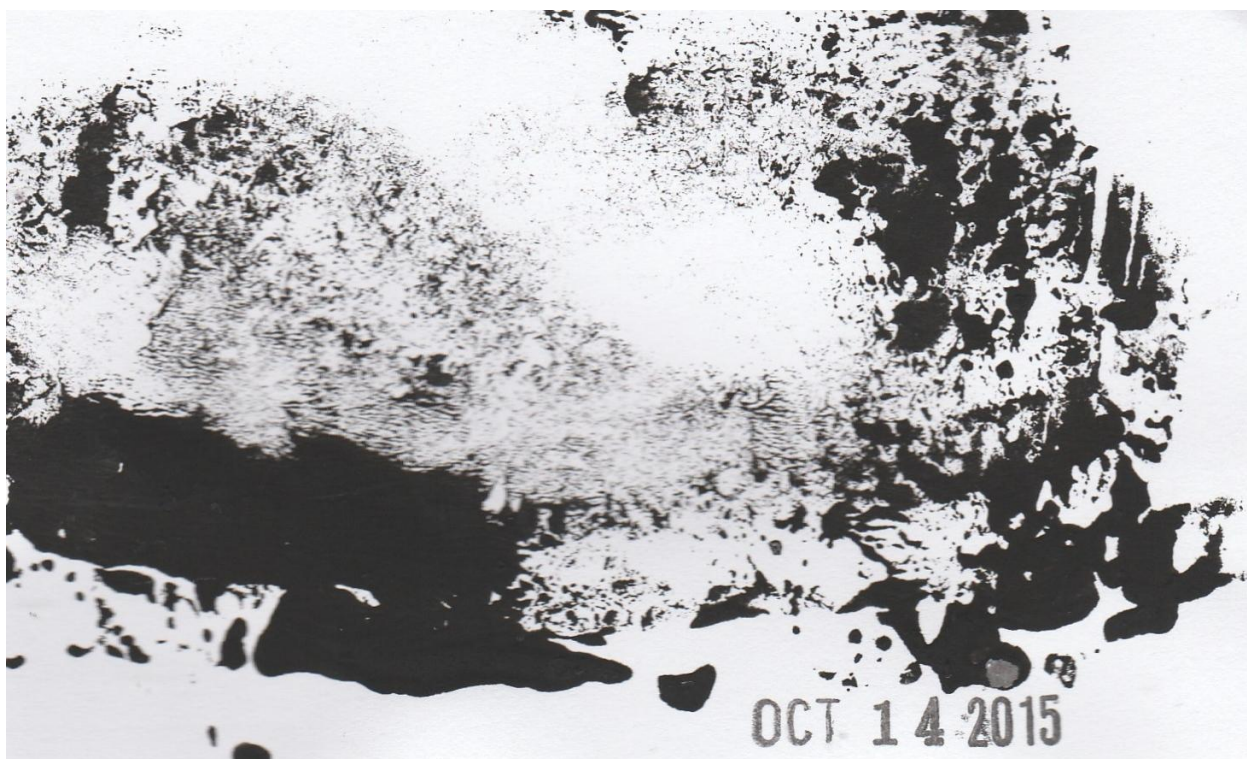




















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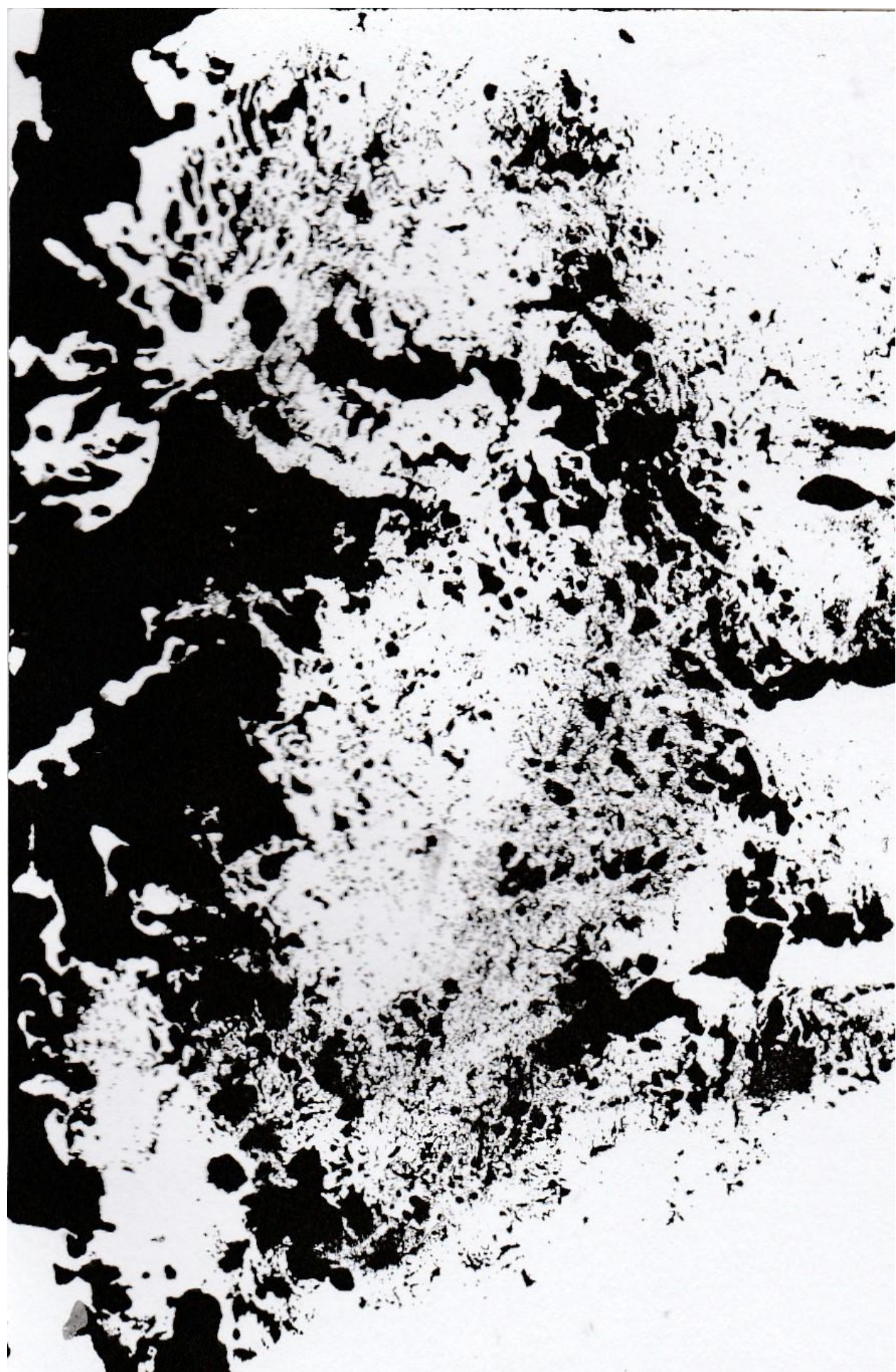
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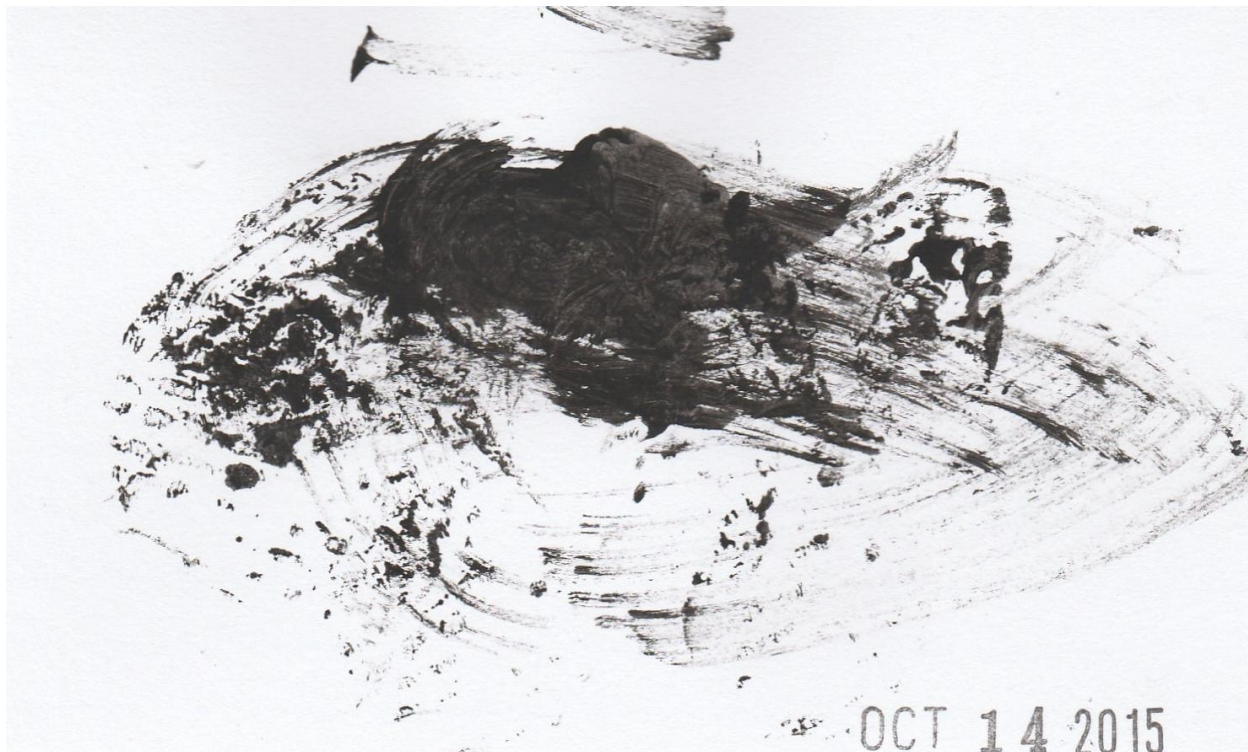
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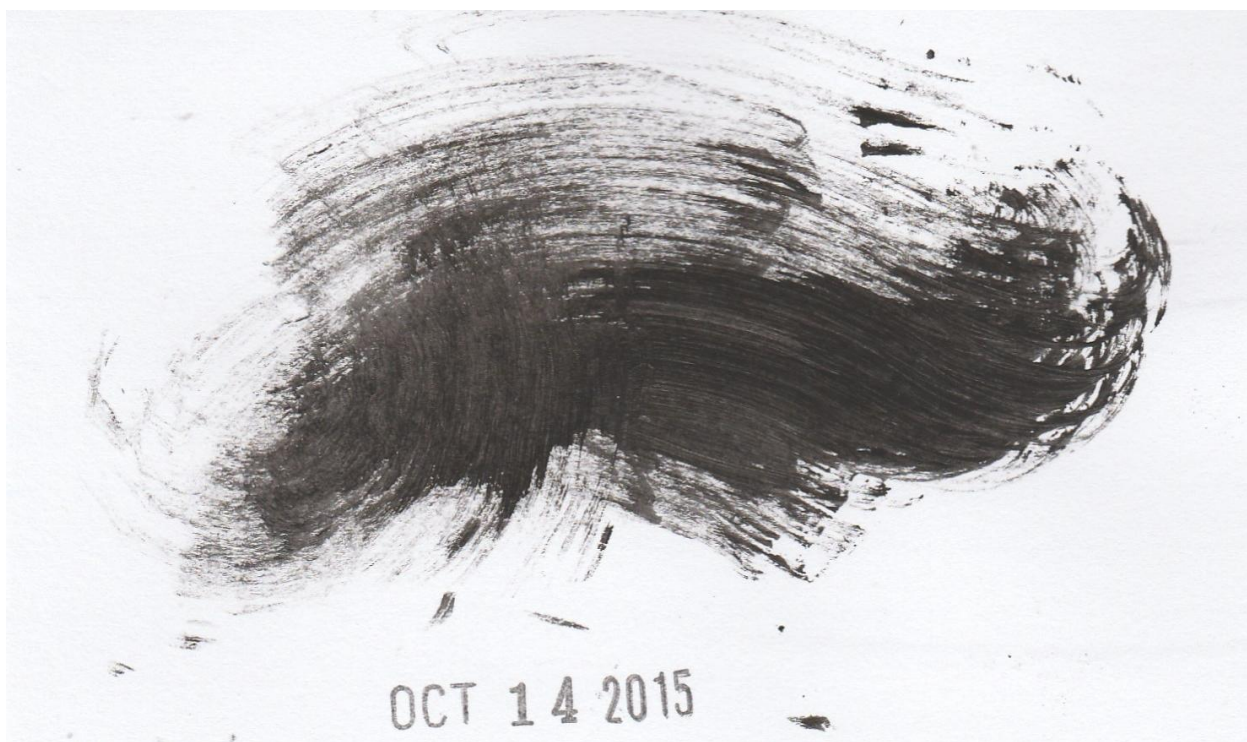


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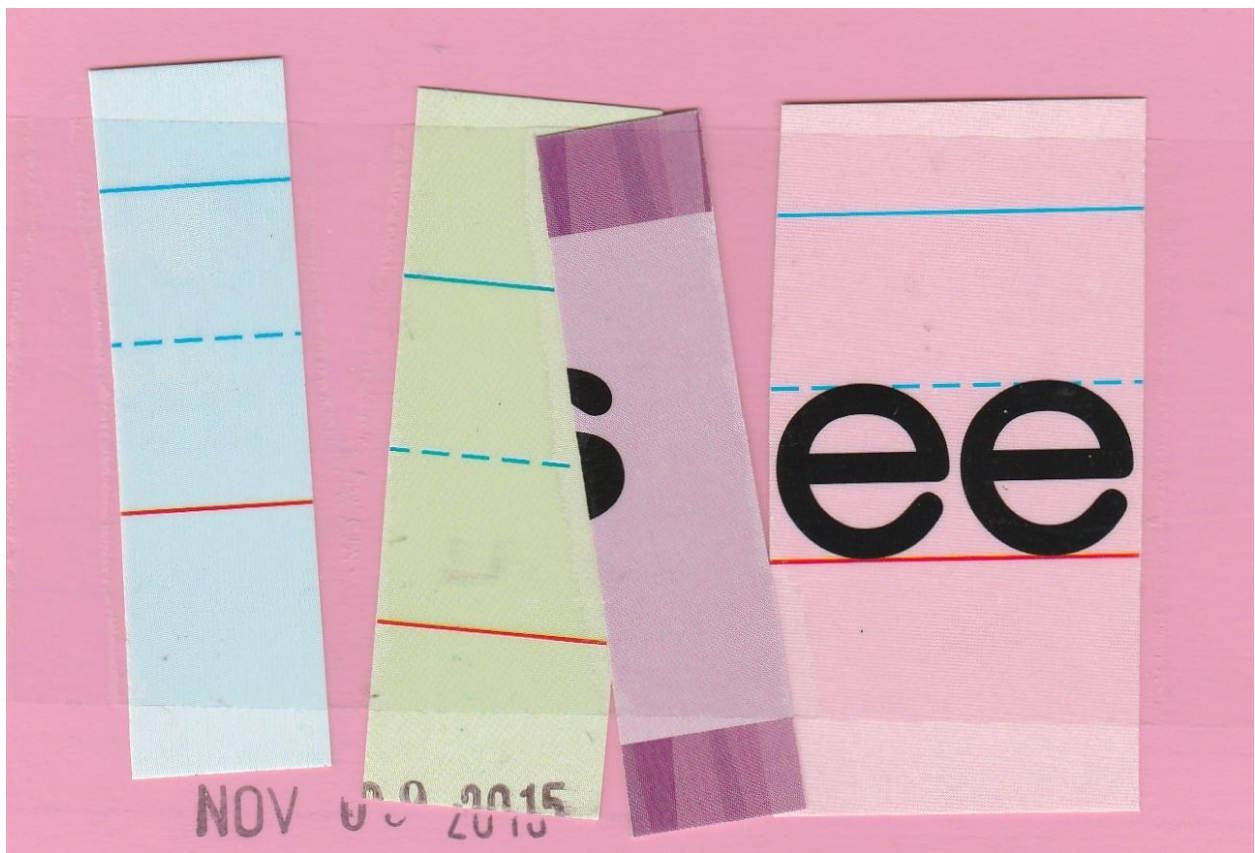
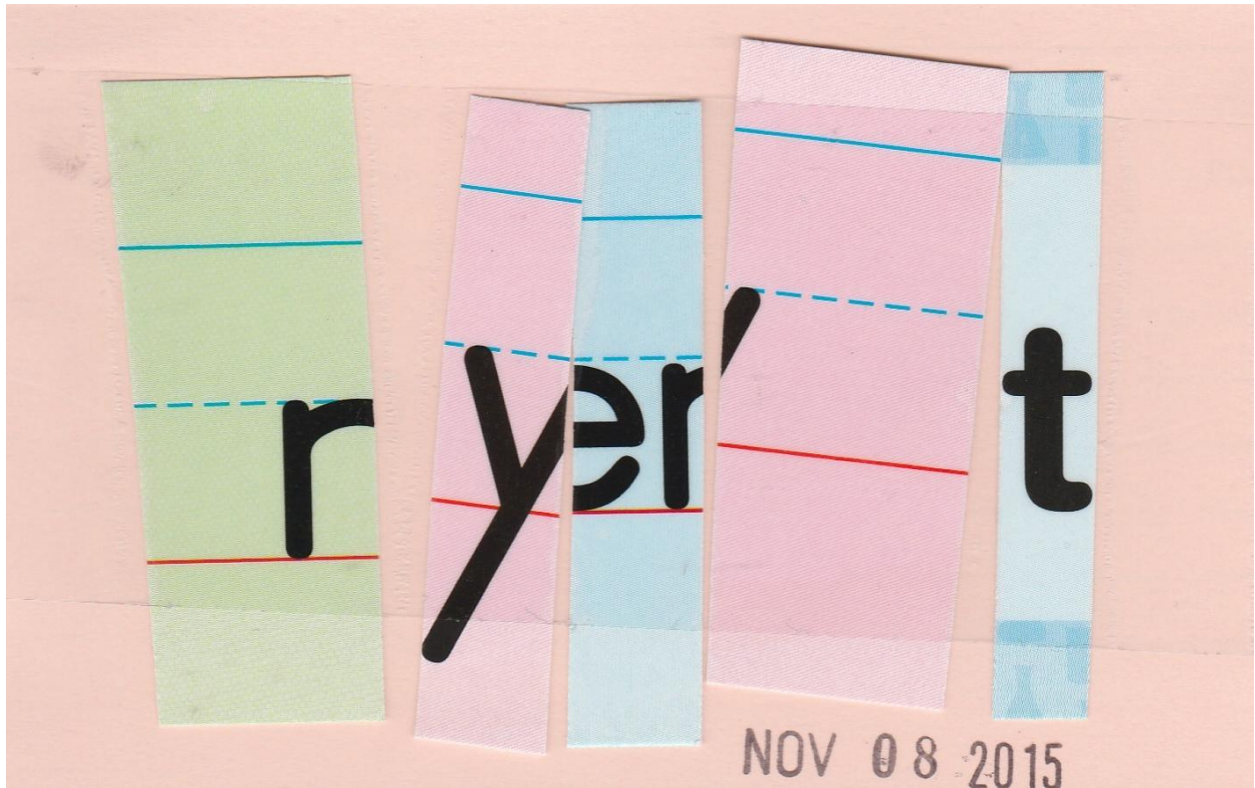




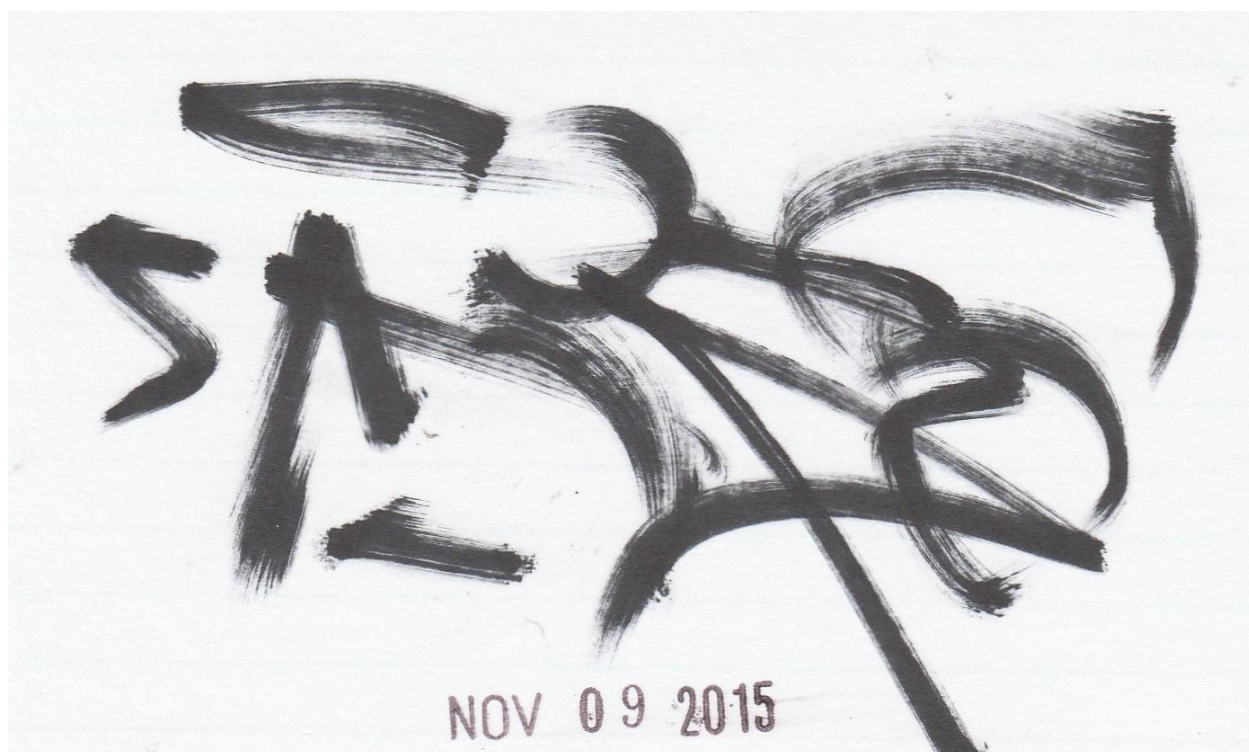
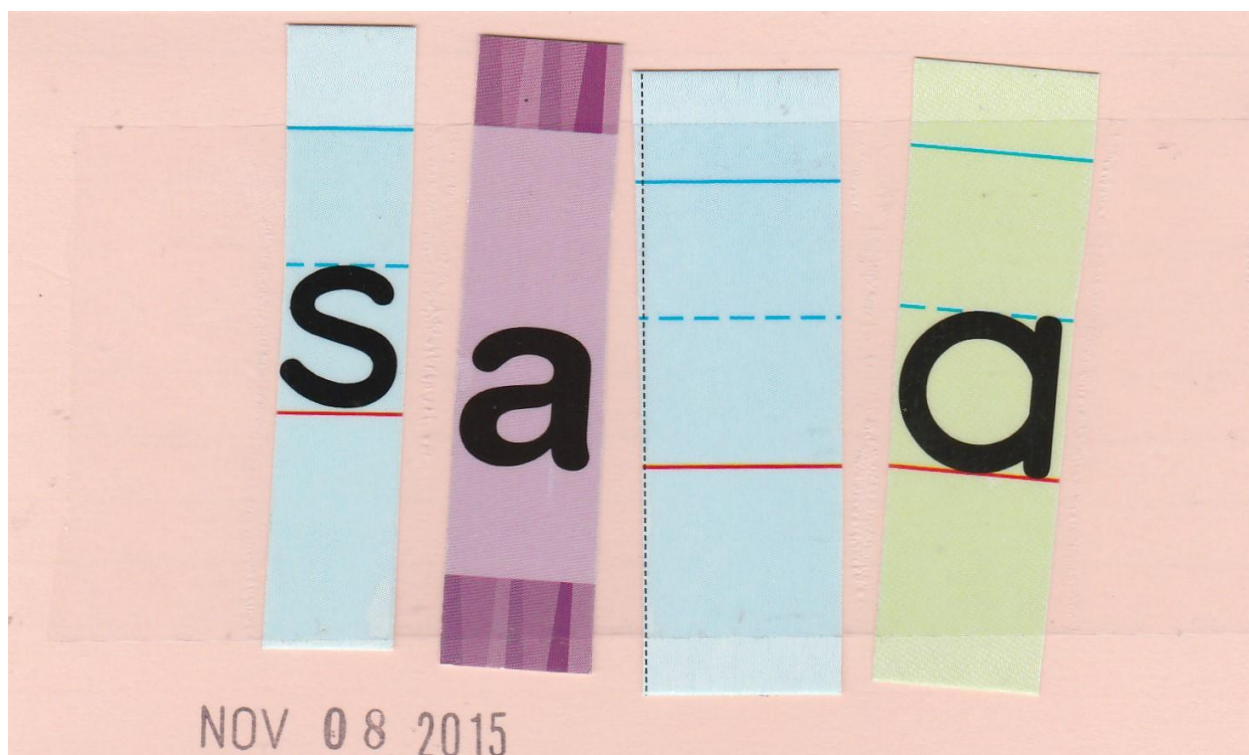


















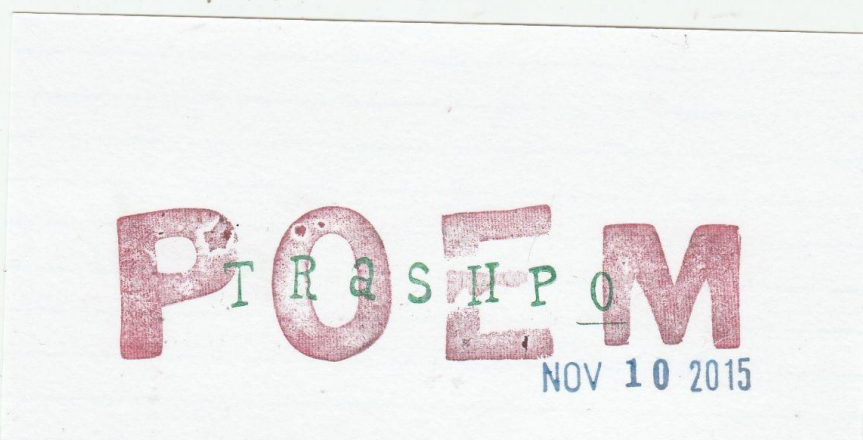
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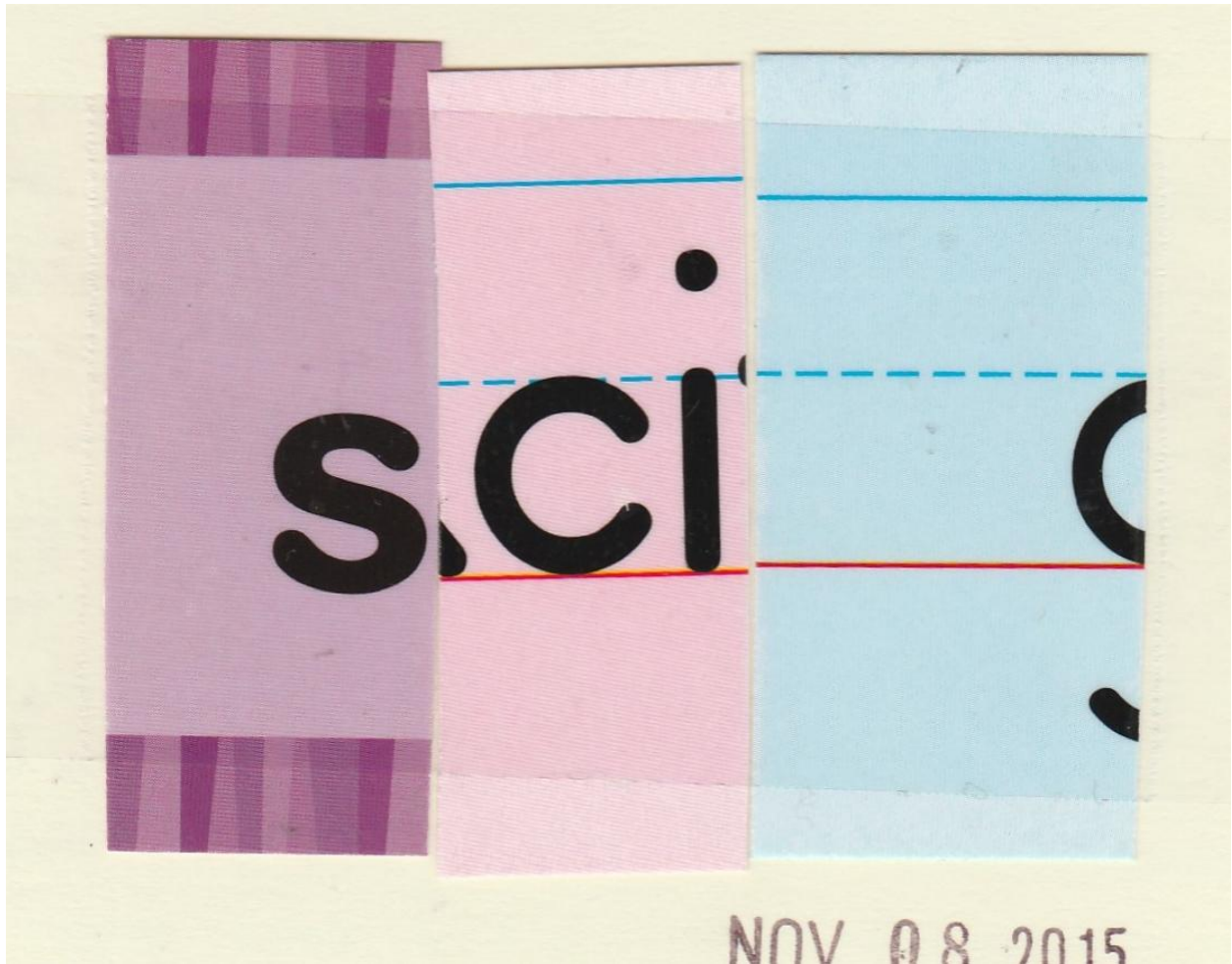
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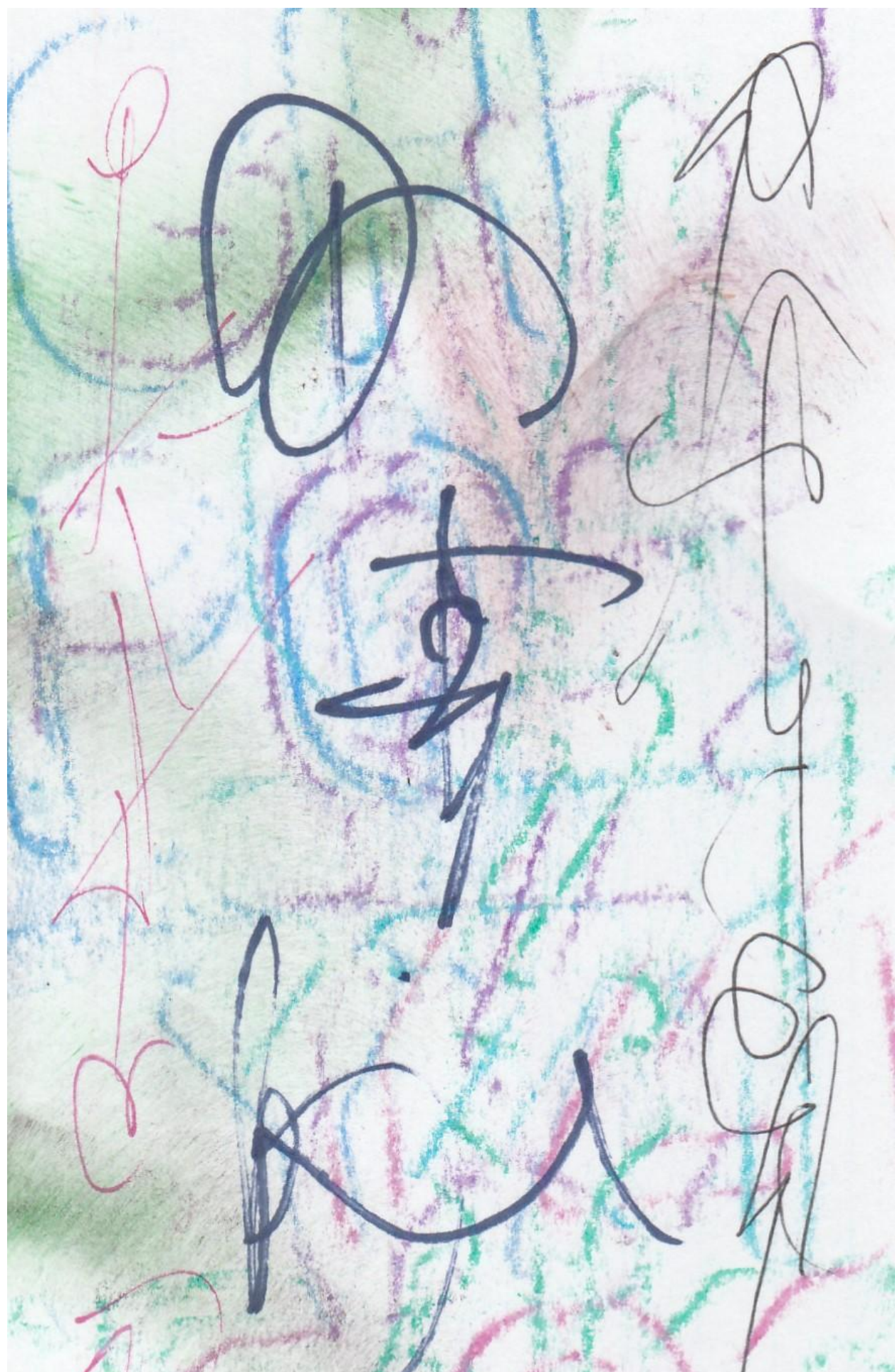
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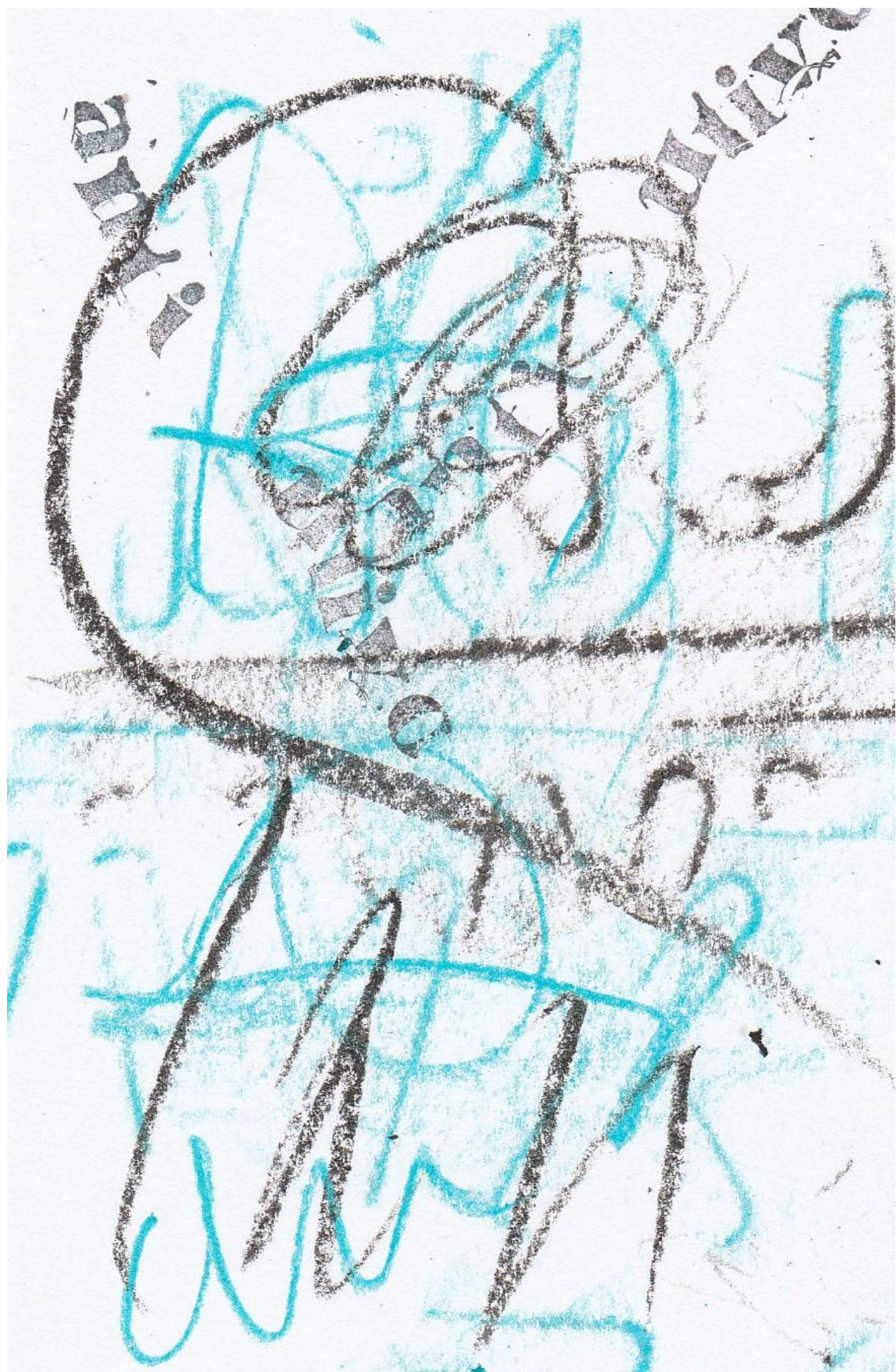




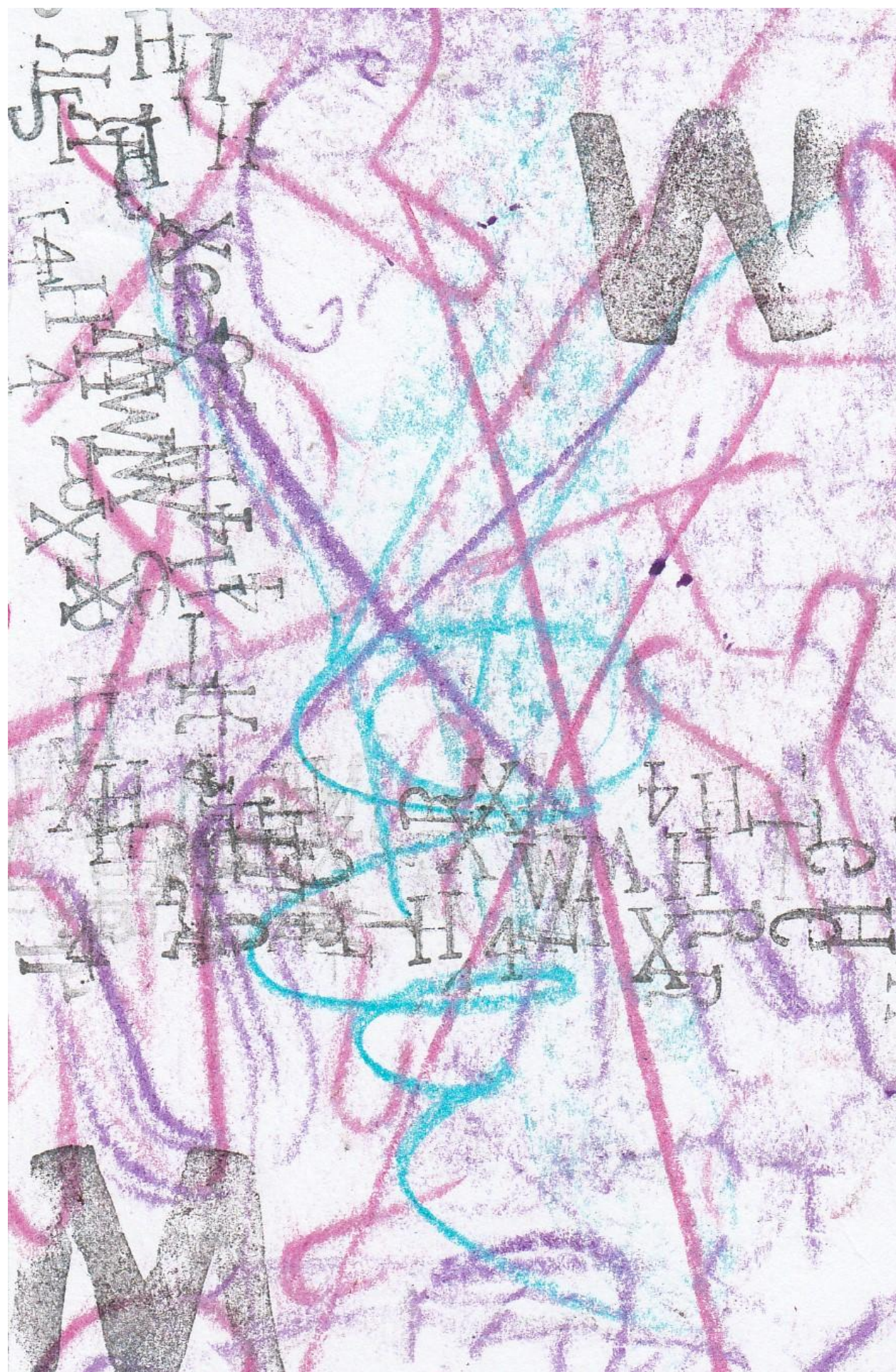
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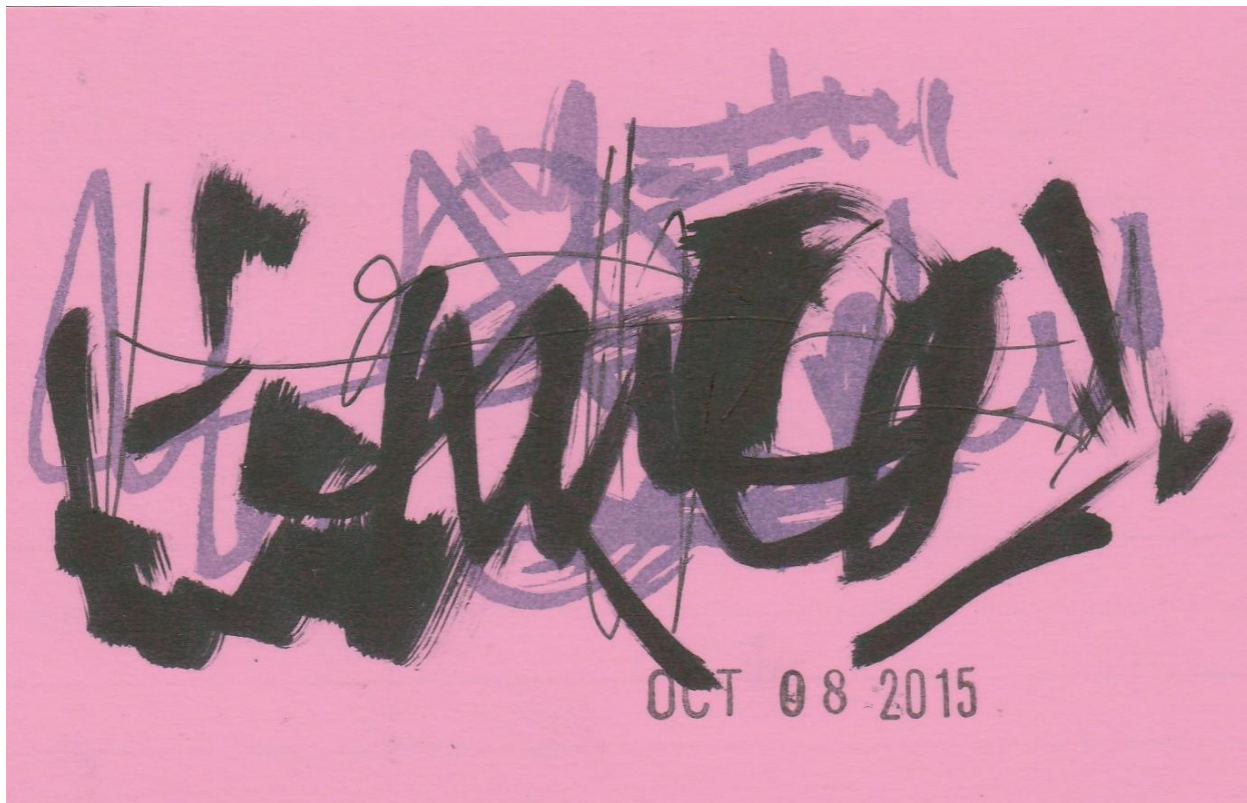




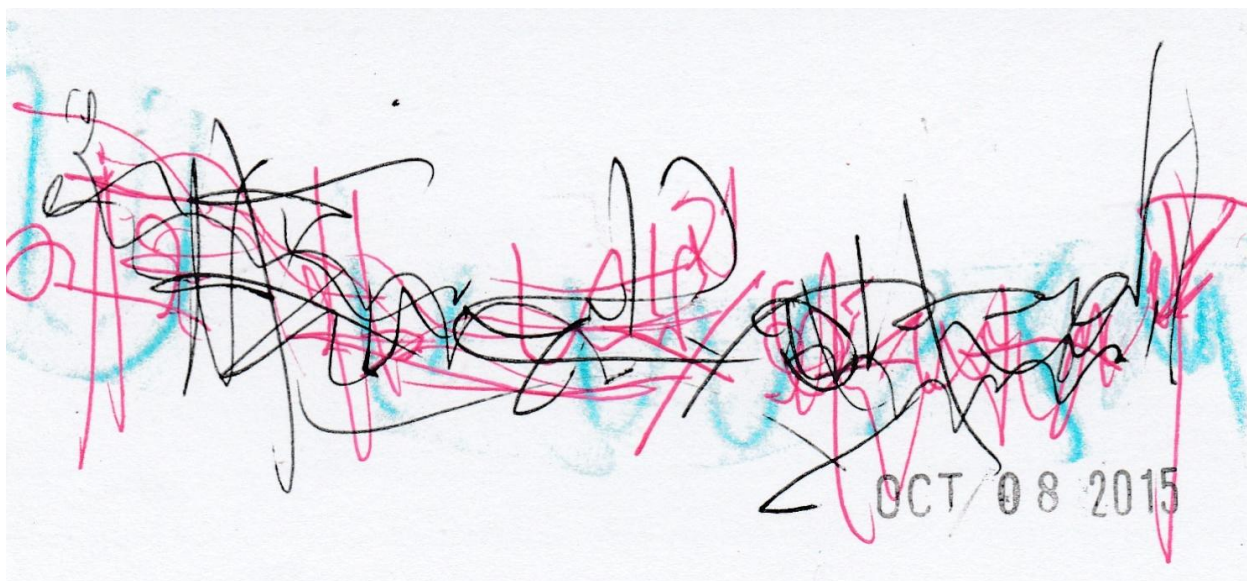




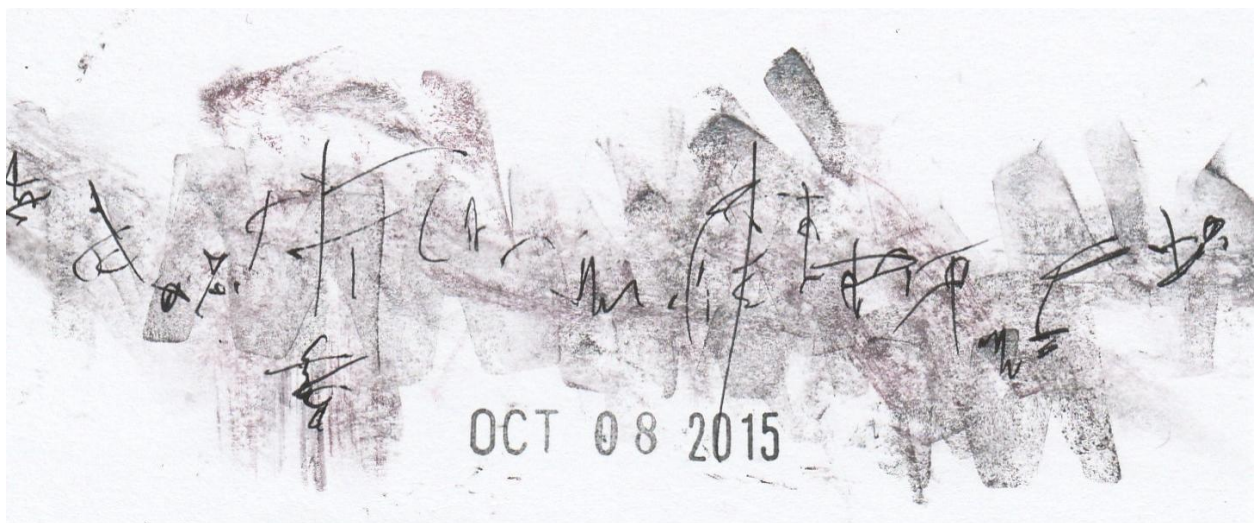




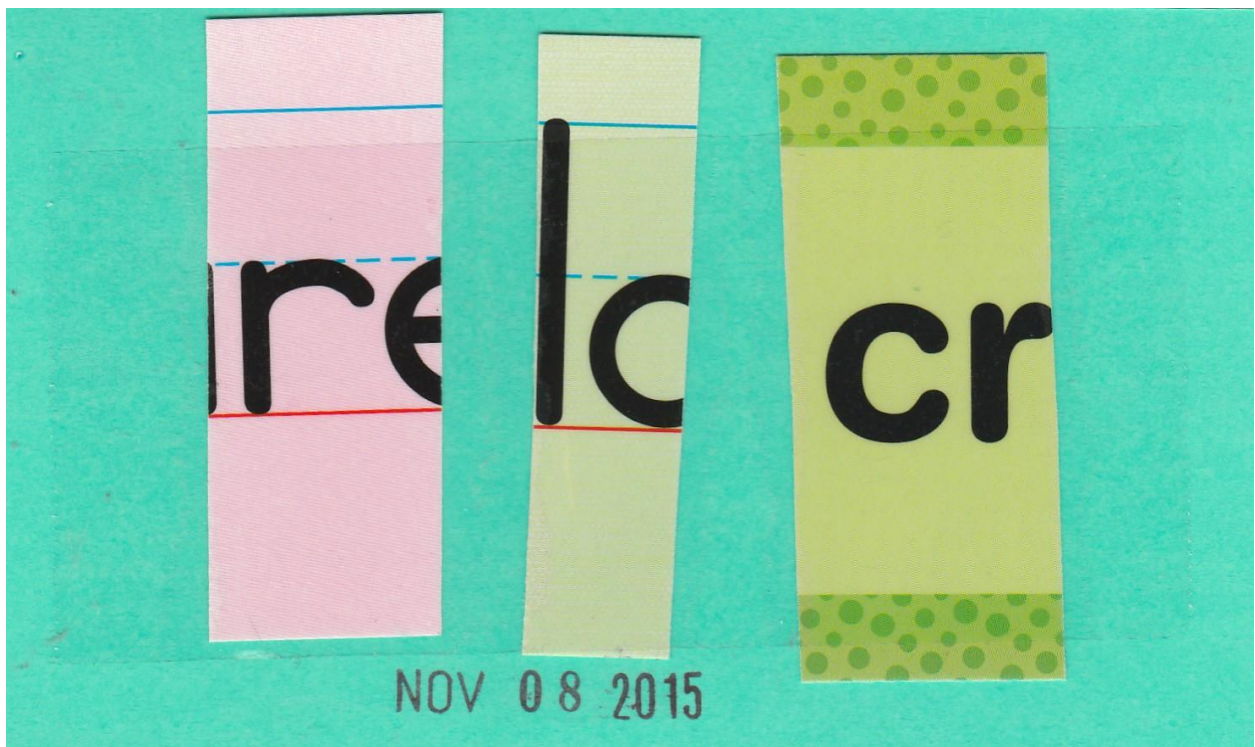
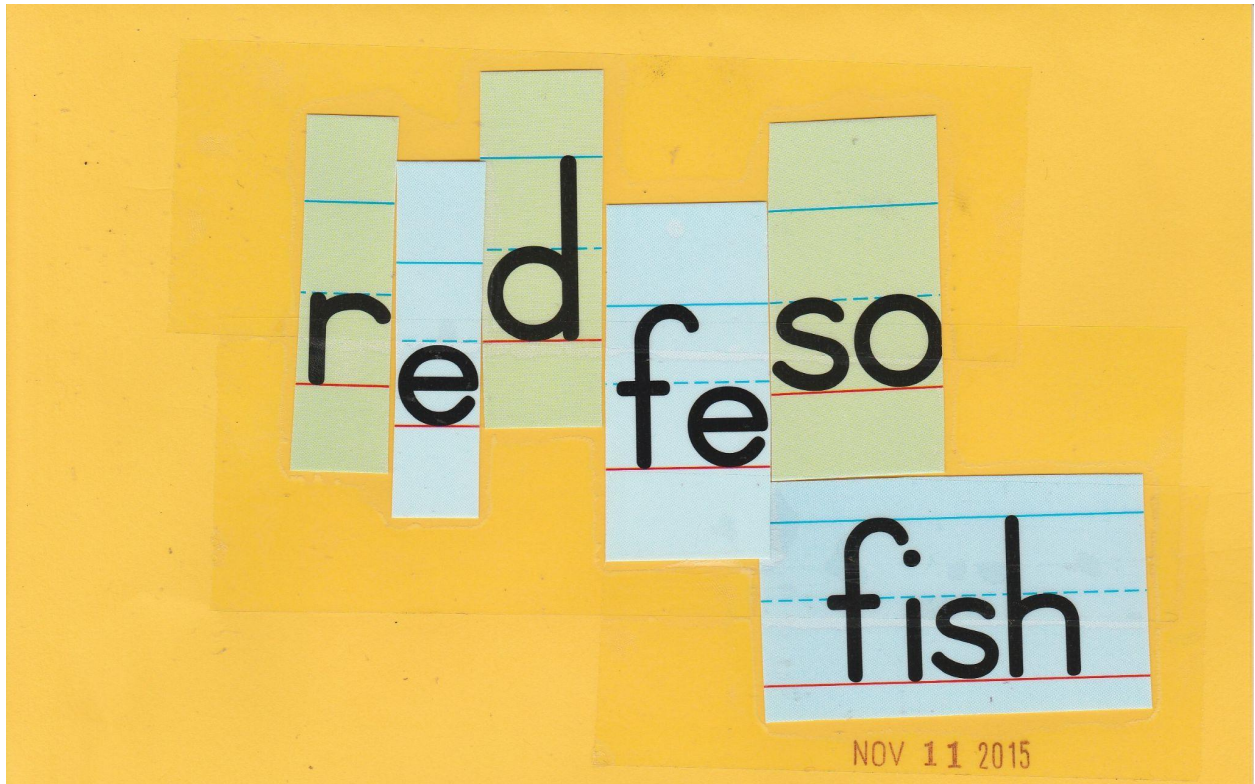
















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